

# The birth of malacology. When and how?

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## Abstract

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In 1795, Georges Cuvier proposed a new classification of invertebrate animals based on anatomical data. He created a new concept of mollusks as representatives of a unique type of morphological organization of animals. Before Cuvier, the name “mollusks” was used only for cephalopods without external shells and slugs, whereas all shelled mollusks were placed in another taxon, Testacea. The Cuvier’s works (1795, 1798) are considered here as the starting point of transformation of classical conchology (= study of shells) into modern malacology (= study of molluscous animals as whole organisms). This process ended in 1825 when the very term “malacology” was finally established by Ducrotay de Blainville.

About two hundred years ago no students of mollusks might identify himself or herself as a “malacologist”. The very term “malacology” did not exist at the time, and the study of snails, clams and other testaceous animals, including barnacles and even foraminiferans, had been known under the name “conchology” or, more rarely, “testaceology” (Maton and Rackett 1804, Wood 1815, Burrow 1815). Most often “conchology” was defined as a branch of natural history devoted to the “study of shells, or Testaceous animals” (Da Costa 1776: 1). Some authors, although, restricted the scope of conchology exclusively to “the structure, properties, and methodical arrangement of shells, the external testaceous coverings of molluscous animals” (Pinnock 1824: 5). The term “malacology” has later origin, and it became common in the titles of handbooks and manuals in the 1840s (e.g., Porro 1838, Swainson 1840). In 1837, Fleming proposed even to get rid of the word “conchology” altogether as being unnecessary (Fleming 1837).

When, why, and how did the classical branch of natural science named “conchology” transform into a new

scientific discipline known as “malacology”? Glaubrecht (2009) recently ascribed the “explicit conceptual reform (i.e., distinction between conchology and malacology)” to none other than Edgar Allan Poe, a great American writer, who was an editor and compiler of a popular book on mollusks entitled “The Conchologist’s first book: A system of testaceous malacology” (Poe 1839). Though it was not more than a simple plagiarism of another book (Gould 1995), Poe seemingly wrote the preface and introduction where the “conceptual reform” was presented.

This observation, however, is not completely true at least due to the fact that the explicit distinction between conchology and malacology was proposed as early as in 1825 by a French zoologist Ducrotay de Blainville (1825), whose priority was acknowledged by Poe (1839). Moreover, the very term “malacology” was invented nine years earlier (in 1814) by an eccentric French-American naturalist Constantine Samuel Rafinesque-Schmaltz (see below). I believe, however, the conceptual shift from conchology to malacology should be examined in the sphere of

taxonomic ideas rather than in definitions and terminological subtleties. “Testaceous animals” as well as “Mollusca” are above all the taxonomic concepts, and historical shifts in their interpretation would help us to fix the point where malacology was born.

## “Testaceous Animals” from Aristotle to Linnaeus

Aristotle was surely the first man of science to study mollusks seriously. In his famous “Historia animalium”, Aristotle gave a collection of his own thorough observations on external morphology, anatomy, reproduction, ecology and behavior of many soft-bodied animals that are classified today within the phylum Mollusca. Aristotle created the first universal classification of animals through his distinction between blooded (vertebrates) and bloodless (invertebrates) animals (Meyer 1855, Pellegrin 1986). The group of bloodless creatures included at least four *gene megista* (great families): insects, crustaceans, testaceans, and mollusks (“Historia animalium”, I, 6). The first two families correspond approximately to the contemporary taxa, whereas testaceans (Ostracoderma) and mollusks (Malakia) are merely two divisions of that large group known today as the phylum Mollusca. Aristotle’s Malakia included mostly cephalopods, while Ostracoderma embraced shelled gastropods and bivalves, as well as some other shelled organisms. Hence, the modern concept of mollusks did not exist in Aristotle’s time, and no serious emendations were made until the end of the 18th century. Leaving aside the numerous works of conchologists of the 17th-18th centuries (which did not substantively change this anatomical classification of invertebrates), the next reference point is Linnaeus’s work on classification of all known animals (Linnaeus 1758). One can find different taxa of mollusks (in modern sense) scattered among three orders of the classis Vermes created by Linnaeus (1758):

1. Order Intestina – genus *Teredo* along with such dissimilar creatures as *Lumbricus* (earthworm), *Hirudo* (leech), *Ascaris* (helminthes), and *Myxine* (hagfish).

2. Order Mollusca – essentially a direct descendant of Aristotle’s Malakia. The genuine molluscan genera (*Limax*, *Doris*, *Sepia* and others) were placed here, accompanied by such genera of soft-bodied aquatic animals from other invertebrate phyla, such as *Medusa*, *Asterias* (starfish), *Nereis*, and *Holothuria*.

3. Order Testacea – a species rich taxon including clams, snails, chitons as well as crustaceans (*Lepas*), annelids (*Serpula*) and scaphopods (*Dentalium*).

This is nothing but a reiteration of the classic system of Aristotle albeit more precisely developed. The presence or absence of the shell was the most important trait for classification, which is why Linnaeus distributed cephalopods between two orders. The shelled genera *Argonauta* and *Nautilus* were placed within Testacea, whereas the rest fell into the order Mollusca. Linnaeus’ system of testaceous “vermes” was not strictly conchological, since he included some external characters of the mollusks’ soft bodies in the diagnoses of some higher taxa and even genera. For example, Linnaeus (1758) used shape and number of tentacles as diagnostic traits for several genera of nudibranchs. Several years later, O.F. Müller (1774) used tentacles and siphons (in bivalves) in his arrangement of freshwater mollusks. This author also transferred the Linnaean genus *Limax* (slugs) to the order Testacea on the basis of the apparent resemblance between shelled and non-shelled continental snails.

But the internal anatomy as a tool for classification of invertebrates was commonly ignored by taxonomists of Linnaeus’ time. Many naturalists of the 18th and even 19th centuries consciously rejected anatomical data in their taxonomic work (Stevens 1994). According to Foucault (2002), the ignorance of the anatomical traits of plants and animals was a distinguishing feature of the “Natural History” in the 17th and 18th centuries. Most taxonomists regarded internal anatomy as redundant and unnecessary for determination of the “Natural system”. A modern zoologist is hardly able to comprehend this ignorance as well as, for example, the rejection of the microscopic data by many prominent systematists of the 18th and 19th centuries (Gooday 1991, Stevens 1994).

Some conchologists declared that the system of mollusks based on anatomy is more scientific than the shell-based one (Da Costa 1776) but they considered the latter as the only useful system due to difficulties concerned with obtaining anatomical material of mollusks for study. For example, Maton and Rackett (1804: 177) believed that “innumerable testaceous animals must ever remain unknown to us, except by the *exuviae* accidentally thrown upon the shores after their death: many of them appear to inhabit inaccessible recesses of the ocean, and others part with life on the point of being removed from their native element”. The first attempts to collect animals from the oceanic floor were undertaken several decades later (Anderson and Rice 2006). Lamarck (1792: 471–472) also stressed that the anatomical material of most testaceous animals are not available for study, therefore their morphological classification (“méthode distributive et distinctive... d’après la considération de animaux”) had to be based on the shells. Furthermore, those rich and enjoyable collections of shells would become almost useless for natural history if the system of Testacea were to be based solely on internal morphology (Lamarck 1792). Da Costa (1776: 4) regarded the anatomical studies of mollusks as “too abstruse and uninteresting” to be worth pursuing.

The end of this anatomical ignorance is often thought to be inspired by Cuvier’s extensive studies on the comparative anatomy of animals. Foucault (2002) considers this as an obvious “epistemological” shift from the classical *Historia Naturalis* to the modern biology. “One day, towards the end of the eighteenth century, Cuvier was to topple the glass jars of the Museum,

smash them open and dissect all the forms of animal visibility that the Classical age had preserved in them” (Foucault 2002: 150).

## The Cuvierian “Revolution” in the malacological systematics

Contrary to Foucault’s (2002) opinion, Cuvier started his anatomical research before he was given a position in the Muséum National d’Histoire Naturelle in Paris in 1795. Being a private tutor in Normandy (since 1788), he seized the opportunity to study the internal structure of different marine animals, including mollusks. His rather brief article devoted to description of molluscan anatomy appeared in 1795 (Fig. 1), and it may be regarded as the starting point of the true “revolution” in the malacological systematics. Cuvier described mollusks as representatives of a special type of organization of invertebrate animals (Cuvier called them “white-blooded animals”)

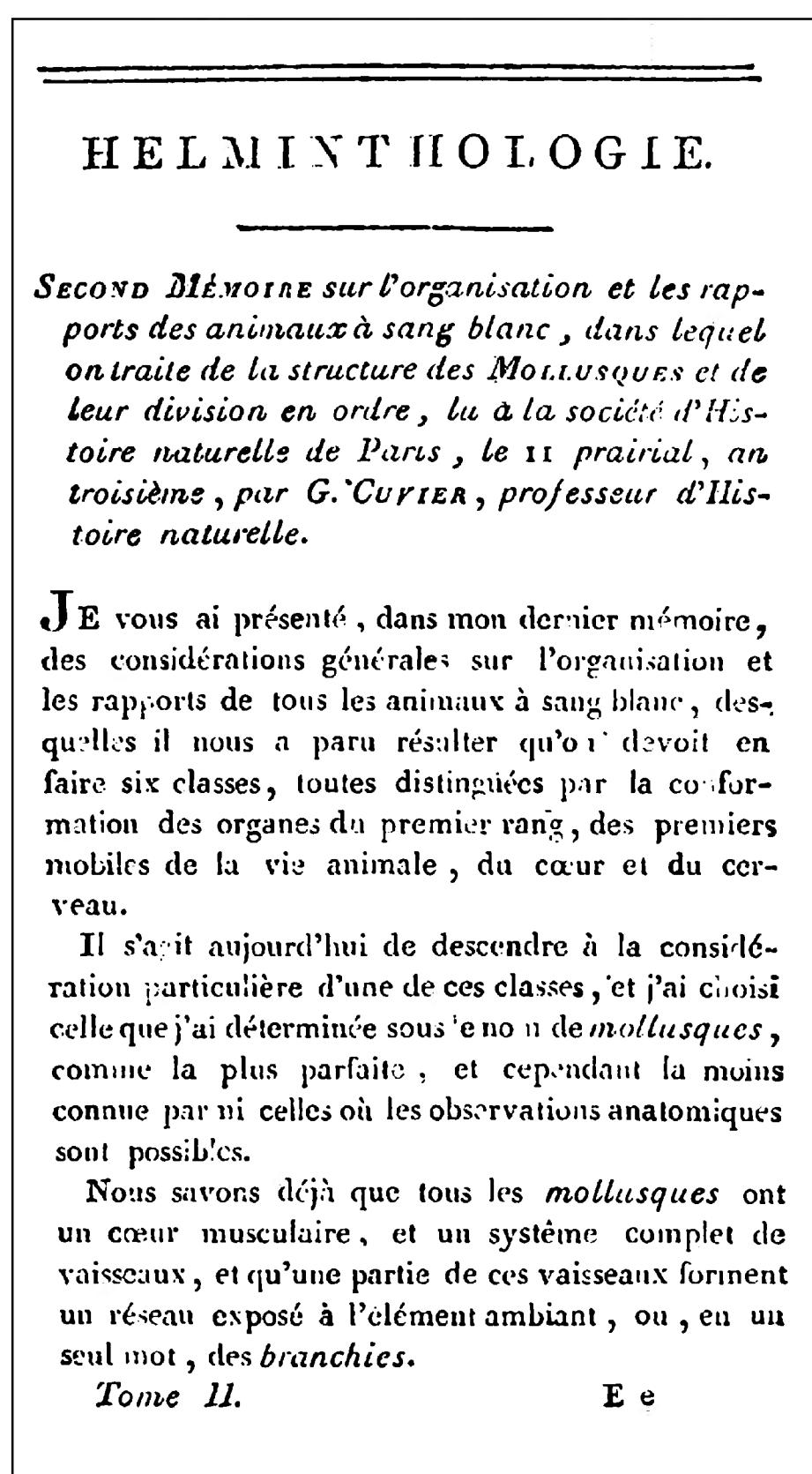
and united both shelled and non-shelled groups in a single taxon (“class des mollusques”). The modern “conception of mollusks” as a distinct group of animals was thus created. Cuvier believed that the internal parts of mollusks are more important for classification than their shells, and his short diagnosis of Mollusca was as follows: “mollusks – a classis of animals that is characterized internally by oviparous reproduction, white blood, existence of heart, blood vessels and gills, liver; and externally – by mantle and tentacles” (Cuvier 1795: 447). His classis of mollusks was divided into three orders still without formal Latin names: “les céphalopodes”, “les gastéropodes”, and “les acéphales” that more or less correspond to the universally known taxa Cephalopoda, Gastropoda and Bivalvia. Dumeril (1806) was the first author to latinize these vernacular names of Cuvier.

A more detailed version of the system was presented in the next important work of Cuvier, «Tableau élémentaire de l’histoire naturelle des animaux» (Cuvier 1798), which listed all known genera of mollusks with their brief diagnoses and descriptions. Inevitably, the first Cuvierian version of the system of Mollusca was not free from errors. Though his new interpretation of mollusks was far closer to the modern one than the interpretations of Aristotle and Linnaeus, Cuvier still classified within «class des mollusques» such diverse and phylogenetically distant aquatic creatures as brachiopods, some crustaceans and tunicates (genera *Ascidia*, *Balanus*, *Lingula*, *Salpa*, *Terebratula*). In total, 59 genera of Mollusca were recognized, and the structure of shells was the main source of information for genera delineation. Most of the genera accepted by Cuvier (1798) had strictly conchological diagnoses.

The next important step of development of the system of mollusks was in 1812, when Cuvier explicitly expressed his great idea that all animals can be distributed among four large branches (embranchements) corresponding to four basic morphological groundplans (Cuvier 1812, Winsor 1976, Eigen 1997). These plans, or principal forms, are utterly independent from each other, and there are no intermediate forms among animals able to fill the gaps between the branches. As Cuvier wrote, any modification of a particular groundplan is slight and “change nothing of the essence of the plan” (Winsor 1976: 7). Mollusks became one of these four branches alongside with vertebrates, articulates and radiates. Cuvier, however, did not consider the four branches as separate phyla in the taxonomic sense, and their names remained vernacular, not latinized.

Cuvier published the last version of the system of Mollusca based on the type concept in 1817, and, somewhat changed, it was proclaimed again in 1830 (Cuvier 1817, 1830). In this system, six classes of mollusks were presented, including, again, phylogenetically distant from true mollusks taxa of tunicates, brachiopods and cirripedes (Table 1).

In 1825, Ducrotay de Blainville proposed a new term, “malacozoaires” (Malacozoa), to designate all these in-



**Figure 1.** The title page of the Cuvier’s “mémoir” on classification of mollusks (Cuvier 1795).

**Table 1.** Cuvier's [1817] classification of molluscs

Group	Classes	Orders
Mollusques	Céphalopodes	none
	Ptéropodes	none
	Gastéropodes	Nudibranches, Inferobranches, Tectibranches, Pulmonés, Pectinibranches, Scutibranches, Cyclobranches
	Acéphales	Acephales testacés (= Bivalvia), Acephalés sans coquilles (= Tunicata)
	Brachiopodes	none
	Cirrhopodes (= Cirripedia)	none

vertebrate animals with soft coverings that corresponded to the Cuvier's diagnosis of "les mollusques". Another term, malacology, was invented for designation of a branch of science devoted to study of malacozoaires. De Blainville wrote: "A branch of science devoted to this part of zoology [i.e. study of Malacozoa] still lacks a name; since *Molluscologie* cannot be used as being a hybrid [word], and since *Conchylologie* is hardly better as it deals with only coverings of these animals, we propose here [a term] *Malacozoologie*, or, in abbreviated form, *Malacologie...*" (Blainville 1825: 2). In the Blainville's book, conchology, or *conchylologie*, remains as a subordinated part of malacology.

Blainville clearly considered his term "Malacologie" as being entirely new. Most probably, he was not aware that nine years earlier, in 1814, the same word was introduced by Rafinesque in a rather obscure pamphlet published in Palermo (Italy) and entitled "Principes fondamentaux de somiologie ou les loix de la nomenclature et de la classification de l'empire organique" (see Robertson 1990, Dance 2011).

Rafinesque attempted to give a special name for each branch of zoology devoted to study of a particular taxon. Some of his terms sound highly exotic. For example, he introduced the term "plaxologie" for the studies of crustaceans, the term "anostologie" for a field of zoology devoted to all invertebrates and so on. "Malacologie" was proposed by Rafinesque to label the study of Malacosia, or mollusques (Rafinesque 1814: 48). Robertson (1990: 145) believes that "Rafinesque had more-or-less the same concept of "Mollusques" as Cuvier (1817)" but, strictly speaking, there was no a clear definition either for Malacosia or for Malacologie in the Rafinesque's brochure. If anything, this small booklet remained virtually unknown among the Rafinesque's colleagues, and Blainville (1825) nowhere demonstrated he knew it.

## The birth of Malacology

Cuvier revolutionized invertebrate systematics through his pioneering studies in comparative anatomy, and should be considered the genuine "father of malacology." The conceptual shift from conchology to malacology took place between 1795 and 1825 when Cuvier developed his new and revolutionary ideas on systematization of invertebrates. This conceptual transition was concerned with

appearance of three new concepts not characteristic for conchology in its classical sense:

1. Mollusks represent a unique plan of organization of animals embracing both shelled and non-shelled species of animals with soft coverings and uniform internal structures. The shell as such is not essential for definition of Mollusca.

2. The shell is only a part of the whole body of a molluscan animal. Shell characters of mollusks are correlated with the structure of their internals that allows conchological traits to be useful for diagnostics and delineation of lower taxa, but shells have only secondary significance for arrangement of classes and order of Mollusca.

3. Shells are worth examining as objects of nature, but conchology as such constitutes merely a part of a broader branch of zoology that deserves a special name for its designation.

Zoologists in 1800-1810s did not express these three concepts explicitly, but all of them were implicitly contained in works of Cuvier and his associates. Rafinesque's and Blainville's formal establishment of malacology addressed this state of affairs and marked the birth of a new scientific discipline by a proper term. Thus, malacology was born nameless until Rafinesque and Blainville's time. This is not a rare case in the history of science. For example, Aristotle, the "father of zoology", contributed very much to biology without knowing the very word "biology", which did not appear until 1802. Similarly, Cuvier and Lamarck worked as true malacologists even before the word "malacology" was introduced to the dictionaries by Rafinesque and their compatriot Blainville.

Thus, the birth of malacology was not a sort of "saltation". Most probably, it was, in reality, a slow "tectonic" shift in zoological thinking that took at least three decades. This process ran parallel with a much larger one, the gradual transformation of "natural history" flourished in the Age of Reason to modern biology (Foucault 2002). Conchology, however, survived this transformation, and is still essential for countless paleontologists, museum curators and private shell collectors.

For those, who still seek for the "exact" date of birthday of malacology, I propose 10 May of 1795 (=21 floréal an III), a day when Cuvier delivered his lecture on the arrangement of "vermes", including mollusks, before the Society of Natural History [see Cuvier 1830: 1]. Is there a better date to celebrate the beginnings of malacology?

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